II. "A Description of some Fossil Plants, showing structure, found in the Lower Coal-seams of Lancashire and Yorkshire." By E. W. Binney, F.R.S. Received May 12, 1865.

(Abstract.)

The author stated that, although great attention has been devoted to the collection of the fossil remains of plants with which our coal-fields abound, the specimens are generally in very fragmentary and distorted conditions as they occur imbedded in the rocks in which they are entombed; but when they have been removed, cut into shape, and trimmed, and are seen in cabinets, they are in a far worse condition. This is as to their external forms and characters. When we come to examine their internal structure, and ascertain their true nature, we find still greater difficulties, from the rarity of specimens displaying both the external form and the internal structure of the original plant. It is often very difficult to decide which is the outside, different parts of the stem dividing and exposing varied surfaces which have been described as distinct genera of plants.

The specimens described were collected by the author himself, and taken out of the seams of coal, just as they occurred in the matrix in which they were found imbedded, by his own hands. This has enabled him to speak with certainty as to the condition and locality in which they were met with.

By the ingenuity of the late Mr. Nicol of Edinburgh, we were furnished with a beautiful method of slicing specimens of fossil-wood so as to examine their internal structure. The late Mr. Witham, assisted by Mr. Nicol, first applied this successfully, and his work on the internal structure of fossil vegetables was published in 1833. In describing his specimens, he notices one which he designated *Anabathra pulcherrima*. This did not do much more than afford evidence of the internal vascular cylinder arranged in radiating series, somewhat similar to that described by Messrs. Lindley and Hutton as occurring in *Stigmaria ficoides*, in the third volume of the 'Fossil Flora.'

In 1839 M. Adolphe Brongniart published his truly valuable memoir, "Observations sur la structure intérieure du *Sigillaria elegans* comparée à celle des *Lepidodendron* et des *Stigmaria* et à celle des végétaux vivants," in the Archives du Muséum d'Histoire Naturelle. His specimen of *Sigillaria elegans* was in very perfect preservation, and showed its external characters and internal structure in every portion except the pith and a broad part of the plant intervening betwixt the internal and external radiating cylinders. Up to this time nothing had been seen at all to be compared to M. Brongniart's specimen, and no person could have been better selected to describe and illustrate it. His memoir will always be considered as one of the most valuable ever contributed on the fossil flora of the Carboniferous period.

In 1849, August Joseph Corda published his 'Beiträge zur Flora der Vorwelt,' a work of great labour and research. Amongst his numerous specimens, he describes and illustrates one of *Diploxylon cycadeoideum*, which, although not to be compared to M. Brongniart's specimen, still affords us valuable information, confirming some of that author's views rather than affording much more original information. All these last three specimens M. Brongniart, in his 'Tableau de végétaux fossiles considérées sous le point de vue de leur classification botanique et de leur distribution géologique,' published in 1847, classes as *Dicotyledones gymnospermes* under the family of *Sigillarées*; amongst other plants his *Sigillaria elegans*, Mr. Witham's *Anabathra*, and Corda's *Diploxylon*.

In 1862 the author published, in the 'Quarterly Journal of the Geological Society' of that year, an account of specimens which confirmed the views of the three learned authors above named as to *Sigillaria* and *Diploxylon* being allied plants; but showed that their supposed pith or central axis was not composed of cellular tissue, but of different sized vessels arranged without order, having their sides barred by transverse striæ like the internal vascular cylinders of *Sigillaria* and *Lepidodendron*. These specimens were in very perfect preservation, and showed the external as well as the internal characters of the plants.

All the above specimens were of comparatively small size, with the exception of that described by Mr. Corda, which, although it showed the external characters in a decorticated state, did not exhibit any outward resemblance to a plant allied to *Sigillaria* with large ribs and deep furrows so commonly met with in our coal-fields, but rather to plants allied to *Sigillaria elegans* and *Lepidodendron*.

In the present communication the author has described some specimens of larger size than those previously alluded to, and endeavoured to show that the *Sigillaria vascularis* with rhomboidal scars gradually passes as it grows older into ribbed and furrowed *Sigillaria*, and that this singular plant not only possesses two woody cylinders arranged in radiating series, an internal and an external one divided by a zone of cellular tissue, both increasing on their outsides at the same time, but likewise has a central axis composed of hexagonal vessels, arranged without order, having all their sides marked with transverse striæ. Evidence is also adduced to show that *Sigillaria* dichotomizes in its branches something like *Lepidodendron*, and that, like the latter plant, a *Lepidostrobus* is its fructification. The outer cylinder in large *Sigillaria* is composed of thick-walled quadrangular tubes or utricles arranged in radiating series, and exhibiting every appearance of having been as hard-wooded a tree as *Pinites*, but as yet no disks or striæ have been observed on the walls of the tubes. *Stigmaria* is now so generally considered to be the root of *Sigillaria*, that it is scarcely necessary to bring any further proof of this proposition; but specimens are described which prove by similarity of structure that the former is the root of the latter.

The chief specimens described in the memoir are eight in number, and were found in the lower divisions of the Lancashire and Yorkshire coal-measures imbedded in calcareous nodules occurring in seams of coal.

No. 1, *Diploxylon cycadoideum,* was from the first-named district, and the same locality as the *Trigonocarpon,* described by Dr. J. D. Hooker, F.R.S., and the author, in a memoir on the structure of certain limestone nodules inclosed in seams of bituminous coal, with a description of some *Trigonocarpons* contained therein*, and the other seven (*Sigillaria vascularis*) were from the same seam of coal in the lower coal-measures in which the specimens described in a paper entitled "On some Fossil Plants showing structure from the Lower Coal-measures of Lancashire"†, were met with, but from a different locality in Yorkshire.

III. "On Symbolical Expansions." By W. H. L. Russell, Esq., A.B. Communicated by Prof. Stokes, Sec. R.S. Received May 13, 1865.

Among the papers on symbolical algebra by the lamented Professor Boole, there is one on the Theory of Development, published in the fourth volume of the 'Cambridge Mathematical Journal.' The expansion of $f\left(x+\frac{d}{dx}\right)$ is there given in a very elegant form. I am desirous to terminate my own investigations on the Calculus of Symbols by pointing out the connexion of the binomial theorems given in my first paper on this subject with the expansions due to Professor Boole, and propose with that view to expand $f\left(x+x\frac{d}{dx}\right)$ in terms of $\frac{d}{dx}$, which will be sufficient to indicate the general method. When the term of the expansion which does not contain $\frac{d}{dx}$ is known, the other terms are easily found by a method given by Professor Boole in the paper I have just mentioned. The main object of the present paper, therefore, will be to ascertain that part of the expansion of $f\left(x+x\frac{d}{dx}\right)$ which does not contain $\frac{d}{dx}$.

Putting, as usual, ρ for (x) and π for $x\frac{d}{dx}$, the expression becomes $f(\rho+\pi)$. Our first object must be to ascertain that part of the expansion of $(\rho+\pi)^n$ which is independent of (π), from whence we may easily deduce the corresponding portion of $f(\rho+\pi)$. Now by a former paper the part of $(\rho+\pi)^n$, independent of π, will be

$$\rho^n+\Sigma n\,.\,\rho^{n-1}+\Sigma(n-1)\Sigma n\rho^{-2}+\Sigma(n-2)\Sigma(n-1)\Sigma n\rho^{n-3}$$
$$+\ \&c.\ +\Sigma(n-r+1)\Sigma(n-r+2)\ldots.\ \Sigma n\rho^{n-r}+\ldots.$$

* Philosophical Transactions, 1855, p. 149.

† Quarterly Journal of the Geological Society of London for May 1862.